OPERATION AND MAINTENANCE MANUAL

LIST OF DOCUMENTS INCLUDED IN THIS SECTION:

DOCUMENT NUMBER	ISSUE	TITLE
RICSYS-MA-CGS-001	1	RICH FM OPERATION and MAINTENANCE USER MANUAL

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ORIGINALE ARCHIVIO

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RICH System

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Titolo : *Title :* RICH TCS REFLECTOR AND MECHANICAL ASSY HANDLING, STORAGE, OPERATION AND MAINTENANCE MANUAL				

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1. SCOPE

The present document contains the information needed to correctly use the RICH TCS and mechanical subsystem hardware developed by CGS in terms of:

- Shipment\handling
- Storage
- Operation
- Maintenance

For technical details on RICH TCS and mechanical subsystem hardware refer to the applicable and reference documentation.

2. DOCUMENTS

2.1 APPLICABLE DOCUMENTS

AD	Document Number	Issue/Date	Rev.	Title/Applicability
1	AMS02-TN-004-CGS	5	02/03/2005	Preliminary Thermal Requirements for AMS02 Internal Interfaces
2	I/020/03/0	n/a	14/05/2003	RICH SYSTEM Contract

2.2 REFERENCE DOCUMENTS

RD	Document Number	Issue/Date	Rev.	Title/Applicability
1	AMS02-TN-CGS-007	Issue 2, 30/11/2005		AMS 120VDC and 28VDC HEATERS DESCRIPTION
2	10-RICSYS-00.001	27/07/2004	/	RICH SYSTEM ICD
3	RICSYS-TN-CGS-003	Issue 1, 21/06/2007		RICH HEATERS AND THERMOSTATS INTEGRATION DESCRIPTION
4	CGS RICH Reflector FM-00102			UNPACKING AND HANDLING PROCEDURES
5	RICSYS-ED-CGS-001	Issue 1, May 2007		ACCEPTANCE DATA PACKAGE RICH SYSYTEM

3. ACRONYMS

AD	Applicable Documents
AMS	Alpha Magnetic Spectrometer (experiment)
CGS	Carlo Gavazzi Space
ECAL	Electromagnetic Calorimeter (detector)
H/W	Hardware
I/F	Interface
ID	Identification
MLI	Multi Layer Insulation
N.A.	Not Applicable
PDS	Power Distribution System
RD	Reference Documents
RICH	Ring Imaging Cherenkov (Detector)
TCS	Thermal Control System
ToF	Time of Flight (Detector)
VDA	Vacuum Deposited Aluminum

4. RICH TCS HARDWARE IDENTIFICATION AND DESCRIPTION

The RICH thermal and mechanical subsystem hardware is composed of:

- Composite Reflector
- Mechanical structure assy
- Thermostats and Heaters
- MLI blankets

In the following picture the Rich Assy is displayed.

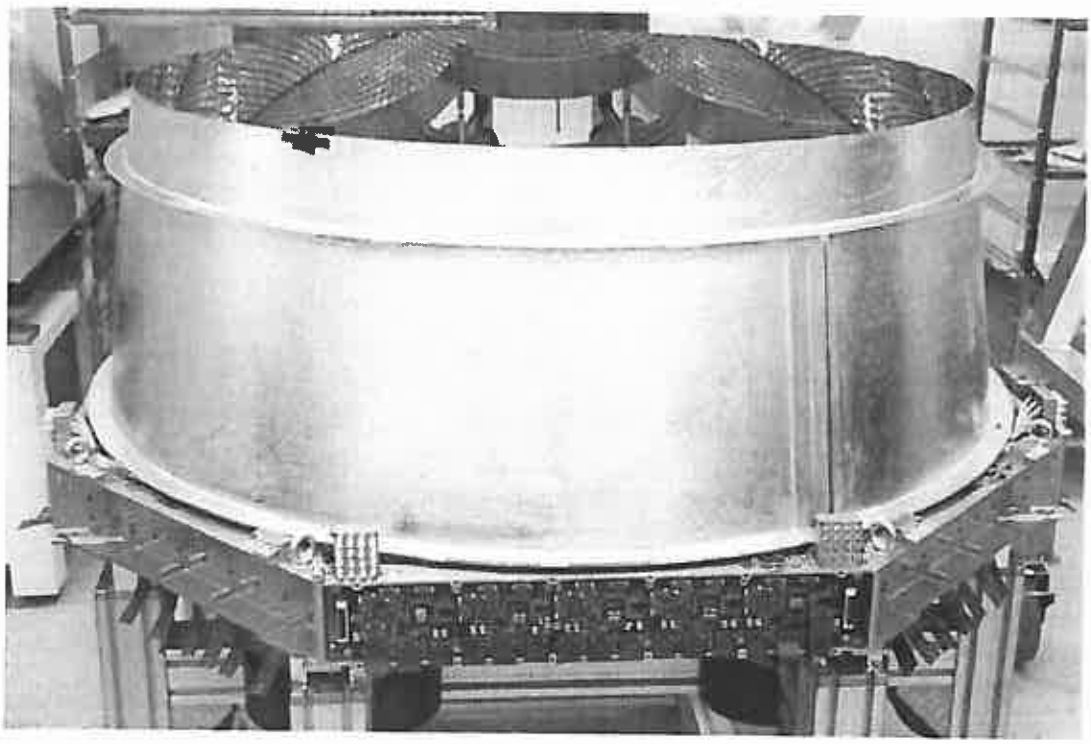

Figure 4-1 RICH detector assembly

4.1 RICH ASSY MECHANICAL INTERFACES

The RICH mechanical interfaces are reported in [AD 2] (10-RICSYS-00.001 Rev. / - RICH SYSTEM ICD) and shown in the following picture:

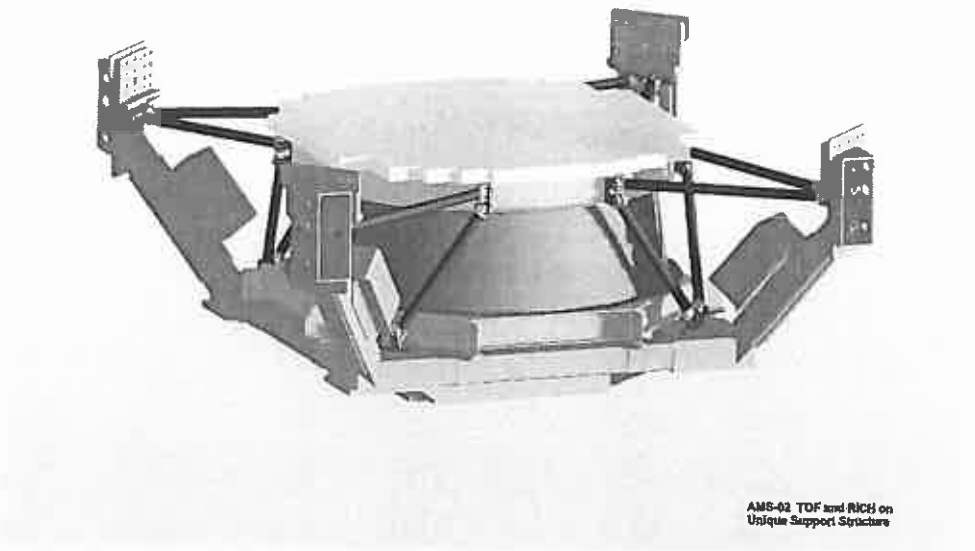

Figure 4-2 RICH mechanical interfaces to the USS

4.2 RICH ASSY ELECTRICAL INTERFACES

The RICH electrical interface (used to supply power to thermostatically controlled heaters) are reported in [AD 3] (RICSYS-TN-CGS-003 issue 1 – RICH HEATERS AND THERMOSTATS INTEGRATION DESCRIPTION)

5. SHIPPING\HANDLING AND STORAGE

The shipping of the RICH TCS and mechanical subsystem HW must happen through its own transportation container to prevent excessive mechanical loads, according to standard space hardware transportation loads.

- Prevent damage and shock to the equipment during transportation.

The following environmental conditions shall be kept during the whole period of transportation:
- Temperature: -20 ÷ +50°C
- Humidity: 20 ÷ 98 %
- Pressure: 959 ÷ 1048 mbar.

The transport container shall not be left for more than 15 minutes when not kept in this type of environment.
The transport container shall not be exposed to direct sunlight or rain.
Desiccants shall be used to preserve the required level of humidity. Silica gel shall be completely enclosed inside its dedicate packet in order to avoid any contamination with flight hardware.

Cushioning material must be used between the units and the outer container. The cushion material:
- Shall avoid the movement of the unit inside the container
- Shall reduce shocks on the unit
- Shall be made of materials which do not deteriorate or disaggregate, avoiding contamination of the unit.
- Shall avoid scratches or physical damage to the unit.

The RICH TCS and mechanical subsystem hardware must be always shipped and stored inside a container able to protect the hardware from unwanted contact with external objects that can damage the surfaces. The container must guarantee sufficient cleanliness and the hardware must be wrapped in antistatic envelope. The same applies if the hardware is temporary stored outside the container. In this case the environmental and cleanliness conditions must be as follows:

- During storage inside or outside container the hardware must be wrapped in antistatic envelope
- Storage temperature in the 20+/-10 °C (-20÷+50°C during transportation)
- Storage humidity 40-70 %RH (20 ÷ 98 % during transportation)
- Cleanliness level Visibly clean

The personnel who are in charge of handling and transportation of the hardware shall be skilled personnel for handling of space qualified hardware.

- During installation, and in all following phases, special case must be paid in order not to damage the inner surface of the Mirror. (see dedicated paragraph for Mirror handling)

For handling of the TCS and mechanical subsystem HW outside the transport container apply the following guidelines:

- Extract RICH TSC and mechanical subsystem hardware from the transport container in at least a visibly clean area (Class 100.000 preferred)

- Wear gloves
- Wear overall headgear and shoes cover suitable for the cleanliness level of the room and appropriate to avoid ESD
- Utilize wrist lace connected to the ground

5.1 REFLECTOR UNPAKAGING AND HANDLING PROCEDURES

Reflector shall be unpacked and handled following the below instructions (Ref [AD 4])

CGS RICH Reflector
FM-00102
Unpacking and Handling Procedures

Unpacking and Handling Procedures
RICH FM Reflector
Serial Number FM-00102

The following is a set of Handling and Packing Procedures for the RICH FM Mirror and Flight Spares, FS, for the AMS-02.

FM Container
The container for shipping the FM is the original container in which the mandrel was shipped to CMA. The FM is bolted to the conical ring supplied in the container by CGS. It is bolted from the 4 mounting points of the FM to 4 corresponding holes on the conical ring.

Unpacking the FM

1. Remove completely the bolts holding the shipping container halves together.
2. Carefully lift the top of the container straight up until the top has cleared the FM.
3 Remove the FM from the mounting cone at the 4 bolt locations at the base flange of the FM.
4. Remove completely the FM and place on a flat surface.

Handling the EM

1. Once the FM is unbolted, it is to be lifted off of the base by holding the reinforcement ribs on the back of the mirror.
2. **Under no circumstance is the surface of the mirror to be touched**
3 Always place the mirror on a flat level surface for storage.
4. Do not place a cover over the mirror unless the cover is designed so that it does not touch the surface of the mirror.
5 Do not place the mirror face down onto any surface for any reason. However, the mirror can be laid flat with the surface facing upward.
6. Do not attempt to clean the surface of the mirror with any chemicals or wipe the surface with a cloth of any kind. Small dust particles can be removed by either gently wiping with a feather duster or an aero or compressed gas duster.

Handling the FS

1. Carefully remove top of FS carton with the carton placed "Top" side up.
2. With gloves, carefully lift the FS out of the carton and place down on a table the convex side.
3. Carefully unwrap the FS covering
4. Use no sharp tools on the concave side of the FS to remove wrap.
5. Either place FS on its bottom edge or on its back side down for storage.
6. It is advisable to place a soft cloth over the FS while it is on the bottom edge.

Cleaning FM/FS Optical Surface

While it is not advisable to touch the optical surface of either the FM or FS, the following must be observed if cleaning should become necessary.

1. Using an aero duster or fine feather duster, carefully wipe any visible particulates from the optical surface.
2. Using a white Kleenex, with no lotion, colorant or scent, place a small amount, 10 – 15cc, of Isopropanol, IPA.
3. Carefully and gently wipe away the contaminated area until no streaking is visible. Do not completely wet the Kleenex with IPA as streaking can occur on the mirror surface, which is difficult to detect.
4. Never Dry Wipe the optical surface of the mirrors.
5. After adequately removing the contamination, carefully wipe away any residual lint from the Kleenex with either an aero duster or a fine feather duster.

Cleaning the Carbon Fiber, CF, Mirror Back and Reinforcement Structure

1. Using a soft lint-free cloth and a small amount of IPA, carefully wipe the contaminated areas of the CF structure.
2. After the contamination has been cleaned, carefully remove any residual lint with either an aero duster or fine feather duster.

6. PRODUCT OPERATION (GROUND) AND LIMITATIONS

Units operations for ground activities have to be performed only by skilled personnel and run in a clean room area (class 100000) and at standard ambient operation:

1. Temperature 22°C ± 3°C
2. Relative Humidity 50% ± 10%
3. Pressure Ambient +1mbar

For operation during test and flight refer to applicable test and flight operation procedures.

Unless otherwise specified apply the following operational limitations:

- Never feed the heaters with a voltage larger than 126VDC

- It is recommended to power the heaters only after they have been connected to their terminal blocks, unless it is strictly necessary to power single patches individually.

- For MLI operation special care must be applied to avoid MLI layers damage.

7. MAINTENANCE

The delivered hardware, once stored and handled according to the present document does not require on ground maintenance.
In case cleaning activity is requested use only isopropyl alcohol and cleaning towels

- Never use on the delivered hardware aggressive cleaning tools.
- Use only isopropyl alcohol for cleaning
- Perform regular visual inspections and in case of detected anomalies contact the supplier.